DISTRIBUTION AND HABITAT OF WHITE-HEADED WOODPECKERS (*PICOIDES ALBOLARVATUS*) IN WEST-CENTRAL IDAHO

by

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ABSTRACT

Distribution and habitat relationships of white-headed woodpeckers (Picoides albolarvatus) are poorly known in Idaho. We estimated distribution and described breeding habitat characteristics of white-headed woodpeckers on the Payette National Forest in west-central Idaho during 1991. We surveyed woodpeckers along 25 variable-width line transects from 5 April-4 June, and conducted nest searches from 15 June-31 July. We recorded 14 detections on nine transects in mature and old stands of mixed Ponderosa pine and Douglas-fir located in the Hitt Mountains and Bear Creek regions. We recorded two additional detections on transects after surveys were completed. Woodpeckers also were detected off transects in the Bear Creek, West Mountains, and Hitt Mountains regions. All observations were in open-canopied stands of relatively low mean tree density. Although density of snags with dbh 26-51 cm on line transects exceeded Forest and Region standards, mean density of snags >58 cm dbh on transects with unsolicited detections was below Regional guidelines. During nest searches we located an estimated nine pairs and found six nests. All nests were in completely dead trees: four in broken-top Ponderosa pine; one in a sawed-off Ponderosa pine stump; and one in a Douglas-fir. Nest trees were in moderate to advanced stage of decay and averaged 56 cm dbh. Average height of nest cavities was 2.8 m. We found nests in dry meadows, a partial cut, and in or along forest edges. White-headed woodpeckers did not nest in stands with canopy cover >26% or tree density >411 trees/ha. Forested stands in 3.1 ha study plots centered on nests were mature to old, open-canopied, and sparsely stocked. Ponderosa pine was the principal overstory species with Douglas-fir a frequent codominant. Forest cover in 50.3 ha study plots centered on nest sites averaged 21 ha (42%) mature, 15 ha (30%) old, and 7 ha (15%) non-forest. Partial cuts with <50% canopy closure were the only silvicultural treatments encountered in study plots. White-headed woodpeckers used a wider range of habitats during the breeding season than has been suggested by previous studies in its northern range. We provided recommendations for managing white-headed woodpecker habitat.

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INTRODUCTION

White-headed woodpeckers (Picoides albolarvatus) range from southern British Columbia south through Washington and Idaho to Southern California and western Nevada (American Ornithologists' Union 1976). The species is scarce and rather local in western Idaho (Burleigh 1972). Its distribution in Idaho is poorly documented, particularly nesting and wintering locations (Stephens and Sturts 1991).

In its northern range white-headed woodpeckers use open-canopied stands of mature and older Ponderosa pine (Pinus ponderosa) and, less frequently, mixed Ponderosa pine and Douglas-fir (Pseudotsuga menziesii) (Cooper 1969, Burleigh 1972, Ligon 1973, Weber and Cannings 1976). They feed mainly on seeds from Ponderosa pine, particularly during fall and winter, and forage for insects on tree surfaces (Ligon 1973, Morrison and With 1987). Trees >25 cm in diameter are preferred for foraging (Morrison et al. 1987, Morrison and With 1987). Nests are commonly excavated in large-diameter (i.e., >58 cm), dead trees in moderate to advanced stages of decay (Bull et al. 1986, Milne and Hejl 1989).

Intensive harvesting of mature, large diameter trees, especially Ponderosa pine, threatens this species (Spahr et al. 1991). The white-headed woodpecker is listed by the Idaho Department of Fish and Game as a Species of Special Concern (Category C, undetermined status), which recognizes the lack of information on their population status, distribution, and habitat

requirements in Idaho (Moseley and Groves 1990). The USDA Forest Service has also classified the species as sensitive in Region 4 (Spahr et al. 1991).

The principal objectives of our study were to 1) estimate distribution of white-headed woodpeckers over an extensive area in west-central Idaho; 2) describe white-headed woodpecker habitat characteristics; and 3) provide recommendations for managing white-headed woodpecker habitat.

METHODS

Survey Areas and Routes

We conducted population and habitat surveys in west-central Idaho on the Weiser and Council Ranger Districts, Payette National Forest. Because this was an extensive rather than intensive survey, we attempted to equally sample four geographic regions within the study area: Hitt Mountains, Cuddy Mountains, West Mountains, and Bear Creek (Figure 1).

We used the line transect method (Emlen 1971) to survey woodpeckers (location of transects are shown in Appendix A). This is an efficient census method appropriate for a species with conspicuous behaviors (e.g., drumming, calling) in relatively open habitat. Moreover, population size estimates can be derived using data from variable-width line transects given an adequate number of detections (n >25 or 30; Burnham et al. 1980).

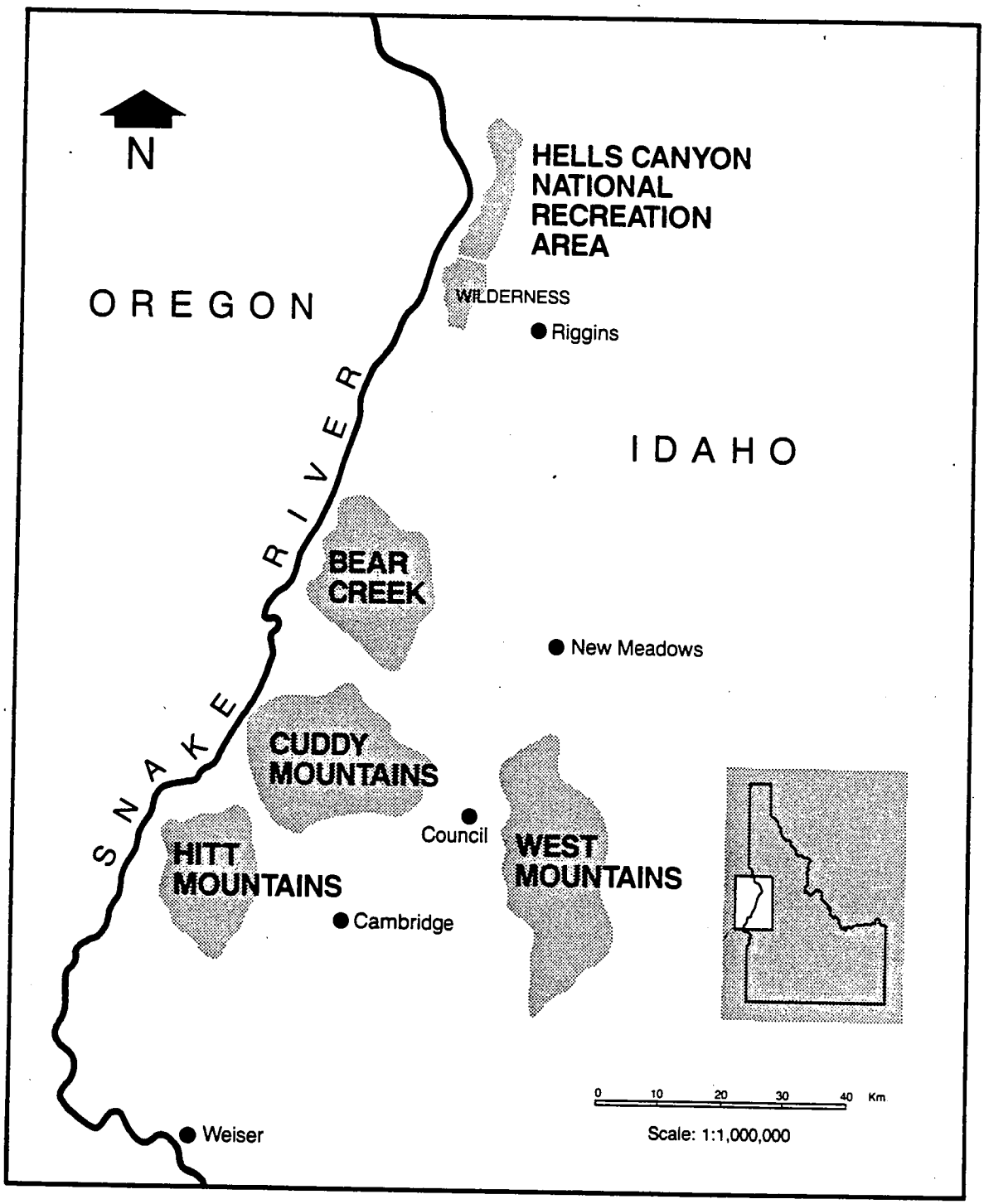

Figure 1. Location of regions in west-central Idaho surveyed for white-headed woodpeckers during 1991.

We selected the largest available mature or older stands of predominantly Ponderosa pine based on recommendations from Forest Service silviculturists and interpretation of forest strata maps and aerial photographs (see Appendix B for definition of forest strata types). We located transects within these stands in areas most likely to contain white-headed woodpeckers.

Line Transect Surveys and Nest Searches

Surveys were conducted from 5 April-4 June to coincide with white-headed woodpecker breeding activity prior to incubation when calling activity is greatest and birds are most responsive to audio-recordings (R. D. Dixon, USDA Forest Service Research Station, La Grande, OR, pers. comm.). Surveys began at official sunrise and ended up to four hours later. We did not survey during rain, fog or wind >15 km/hr. Perpendicular distances from the transect line to visual and aural detections of all woodpecker species were estimated. We plotted visual detections of white-headed woodpeckers on aerial photographs and orthophotographic maps.

Each transect was surveyed twice. The first survey was conducted without soliciting responses. During the second survey, conducted at least 5 days later, we used an audio-recording of white-headed woodpecker drumming and calls to solicit responses. Solicited responses were not used to estimate density or habitat use due to sampling bias associated with influencing a bird's detectibility and location.

Nest searches began on 15 June, when adults were feeding nestlings and, therefore, more conspicuous than during egg laying and incubation (R. D. Dixon, pers. comm.). We attempted to relocate all white-headed woodpeckers recorded during previous surveys and follow them to their nest site. Nest searches were repeated until we either located a nest or determined a pair was not nesting in a particular area.

Habitat Sampling

We sampled habitat along the line transects used to survey woodpeckers. Our sampling methods were similar to those of an ongoing white-headed woodpecker study in Oregon (R. D. Dixon, pers. comm.). Sampling points were selected at 160 m intervals by pacing 15 m in a random direction. At each sampling point we recorded percent canopy cover (with densiometer), silvicultural treatment, dominant plant cover (i.e., plant species with greatest cover), and successional stage (mature or old). Old forest stands had multiple canopies and large diameter (dbh >64 cm) trees and snags. Snags within 0.4 ha (36-m radius) were recorded by dbh (diameter at breast height) class following Bull et al. 1990. We used the point-centered quarter method (Cottam and Curtis 1956) to estimate average density and dbh of live trees with dbh >2.5 cm in forested stands (i.e., >10% canopy cover).

We used the Mann-Whitney test (Zar 1984: 138-141) to test the hypothesis that mean tree dbh, canopy closure, tree density, and snag density on transects with white-headed woodpecker

detections did not differ from that found on transects lacking detections. We inferred statistical significance when $P \leq 0.01$.

For each nest tree we recorded the following information: tree species, height of tree (to nearest 1 m), height of nest opening (to nearest 0.1 m), percent of tree covered by bark (visual estimate), snag condition rating (visual rating according to Thomas et al. 1979, see Appendix C), azimuth of nest opening, dbh (to nearest 0.01 m), and evidence of decay and disease. We calculated mean azimuth ($\underline{\theta}$) and magnitude of mean azimuth ($\underline{r}$) of nest openings according to Zar (1984: 428) At each nest site we recorded dominant plant cover, successional stage, silvicultural treatment, slope angle, and percent canopy cover.

Nest site selection and nesting success may be affected by habitats immediately surrounding nest sites as well as habitats within the larger landscape. Consequently, we measured habitat surrounding nests in circular plots measuring 3.1 ha (99-m radius) and 50.3 ha (400-m radius). We subsampled the 3.1-ha area using five, 0.04-ha (11-m radius) circular subplots clustered about a nest tree (see Noon 1981). The first subplot was centered on the nest tree; four other subplots were positioned 50 m away in the cardinal directions. We sampled the same habitat variables in each subplot as at the nest site. Additionally, all snags were counted within the 0.04-ha subplots.

We used a 50.3-ha plot in the landscape scale analyses because this area would incorporate an average size territory, at least 10 ha in size (Milne and Hejl 1989), as well as adjacent

stands. Silviculturists demarcated forest strata on aerial photographs (scale 1:15840) or orthophotographic maps (scale 1:24000) based on photographic interpretation of stand age and past silvicultural treatment (see Appendix B for strata definitions). We used a planimeter to measure area of each strata type (to nearest 1 ha) as well as length of edge (to nearest 1 km) adjoining uncut forest and meadows, partial cut and clearcut harvest units, and non-commercial forest stratum.

RESULTS

Distribution

We recorded white-headed woodpeckers in the Bear Creek, West Mountains, and Hitt Mountains regions (Table 1). Mated pairs and nests were found in Bear Creek and Hitt Mountains. Most locations were surveyed repeatedly during follow-up nest searches; consequently, certain individuals undoubtedly were recorded more than once. Following is a region-by-region assessment of detections.

At least four pairs were detected in the Bear Creek region. Two active nests were found on 7 July on ridges above Bear and Cuprum. Single birds observed at School Section Gulch and Summit Gulch were probably members of these pairs. A juvenile seen within 150 m of the Bear nest site on 8 August suggests a successful nesting attempt at this location. We relocated a pair

Table 1. White-headed woodpeckers detected on the Weiser and Council Ranger Districts, Payette National Forest, Idaho, during 1991.

Region Location	Date (m-d)	Observation	UTME	UTMN	TRS
Bear Creek					
Bear	5-18	male, drumming	525,300	4,988,700	T20N,R3W,S23,SW
Bear	6-15	pair, foraging	525,100	4,988,400	T20N,R3W,S22,SE
011 Bear	7-7	pair and nestlings nest	525,500	4,988,500	T20N,R3W,S23,SW
Bear	8-10	male, juvenile			
Bear Guard Station	8-10	female, foraging	528,400	4,991,100	T20N,R3W,S13,NE
012 Cuprum (ridge)	7-7	pair and nestlings nest	523,700	4,991,000	T20N,R3W,S16,NE
Lafferty Campground	6-10	male	527,300	4,976,100	T19N,R3W,S36,SW
Lafferty Campground	7-1	pair, foraging ? Probable nest	527,200	4,976,000	T19N,R3W,S36,SW
014 Lafferty Campground	7-9	pair, foraging	527,200	4,976,100	T19N,R3W,S36,SW
Lafferty Campground	7-31	pair, foraging	527,300	4,976,400	T19N,R3W,S36,NW
School Section Gulch	5-18	single	524,300	4,990,600	T20N,R3W,S15,SW
Summit Gulch	5-7	single, foraging	523,800	4,987,800	T20N,R3W,S28,SE
032 Windy Ridge	5-26	pair ? Possible nest	516,400	4,986,400	T20N,R4W,S35,NW
Windy Ridge	5-26	male nearby	516,400	4,985,800	T20N,R4W,S35,NW
West Mountains					
Bar Creek	7-19	male	555,700	4,945,100	T15N,R1E,S2,SE
Cabin Ck. Campground	4-17	single	557,700	4,944,600	T15N,R1E,S12,NE
Cabin Ck. Campground	6-2	single, flying	557,100	4,945,300	T15N,R1E,S1,SE
Hitt Mountains					
033 Hitt Creek	7-25	pair	506,700	4,931,700	T14N,R5W,S23,NW
Middle Fk. Brownlee Ck.	5-14	single	506,100	4,946,100	T15N,R5W,S3,NE
015 Middle Fk. Brownlee Ck.	7-18	pair and nestlings nest	506,700	4,946,400	T16N,R5W,S35,SW
Middle Fk. Brownlee Ck.	7-18	pair	507,000	4,946,900	T16N,R5W,S35,SW
Middle Fk. Brownlee Ck.	10-4	three, foraging	506,700	4,946,400	T16N,R5W,S35,SW
Mill Creek (lower)	5-15	pair, foraging	509,200	4,945,400	T15N,R5W,S1,SE
Mill Creek (lower)	5-29	female, foraging	509,400	4,943,900	T15N,R5W,S12,SE
Mill Creek (lower)	6-29	female	509,800	4,945,600	T15N,R5W,S1,NE

Table 1. (continued) White-headed woodpeckers detected on the Weiser and Council Ranger Districts, Payette National Forest, Idaho, during 1991.

Region Location	Date (m-d)	Observation	UTME	UTMN	TRS	
						08SMO
016 Mill Creek (lower)	7-16	pair and nestlings WEST	510,100	4,945,400	T15N,R4W,S6,SW	90417
Mill Creek (upper)	5-29	male, drumming	509,700	4,945,500	T15N,R5W,S1,SE	ENTERED
Mill Creek (upper)	5-29	male, drumming	508,900	4,944,800	T15N,R5W,S1,SW	ENTERED
Mill Creek (upper)	6-29	male, foraging	509,100	4,944,200	T15N,R5W,S12,NE	ENTERED
017 Mill Creek (upper)	7-17	pair and nestlings WEST	509,100	4,944,100	T15N,R5W,S12,NE	90418
Mulmick Gulch	5-27	male; another heard	505,000	4,934,200	T14N,R5W,S9,SE	ENTERED
Mulmick Gulch	5-27	male	504,900	4,933,800	T14N,R5W,S9,SE	ENTERED
Mulmick Gulch	5-27	single, calling	504,600	4,933,500	T14N,R5W,S9,SE	ENTERED
Mulmick Gulch	6-3	female, enter cavity	505,100	4,933,900	T14N,R5W,S10,SW	ENTERED
019 Mulmick Gulch	7-15	pair and nestlings WEST	505,100	4,933,900	T14N,R5W,S10,SW	90419

at Lafferty Campground on three separate occasions but did not find a nest. We located at least one pair on Windy Ridge but were unable to search for nests here before logging began.

Only single birds were observed in the West Mountains. We recorded two observations within 150 m of Cabin Creek campground, and saw one male at the edge of a recent clearcut.

Hitt Mountains contained the greatest number of detections ($n \geq 5$ pairs). Two nesting pairs were found in the Mill Creek drainage. We also found a nest on a bench 100 m above Middle Fork Brownlee Creek in an area scheduled for timber harvest. Two pairs recorded on 18 July were probably the same birds nesting at this site. Three birds observed foraging together on 4 October may have fledged from the Middle Fork Brownlee Creek nest. We watched a female enter a cavity on 3 June in the Mulmick Gulch area, and recorded an active nest in the same snag on 15 July.

We recorded five detections during a concurrent study of flammulated owls in Hells Canyon NRA (Appendix D). These observations were incidental to the main objectives of the owl study. We did not conduct nest searches. Several observations of white-headed woodpeckers reported to us during our survey are also presented in Appendix D.

Line Transect Detections

We located transects in contiguous old forest stands ($n = 11$), mature stands ($n = 8$), and combinations of old and mature stands ($n = 3$, Table 2). In addition, three transects were located within or bisected partial cuts (i.e., selectively

Table 2. Characteristics of line transects used to survey woodpeckers, and number of white-headed woodpecker detections, Payette National Forest, Idaho, during 1991.

region / transect name	length (km) of transect in strata type[1]			percent of transect with dominant overstory[2]					number of detections[3]	
	pc	old	mat.	pp	df	pp/df	gf	other	us	s
Bear Creek										
Bear	1.0			75		25				1
Bull Gulch		0.5		nd	nd	nd	nd	nd		
Cuprum[4]		1.06			37	63				
Deer Creek	0.53			67		33				
Elk Creek		1.68			33	67				
School Sect. Gulch		0.31	0.82	17	33	50				1
Summit Gulch			0.62	33		67			1	
Windy Ridge 1		0.49	0.17		75	25				2
Windy Ridge 2		0.79	0.74		25	75			1	
West Mountains										
Boulder Creek		1.58		100						
Little Weiser R.			1.75		40	30	10	20		

Table 2. (continued) Characteristics of line transects used to survey woodpeckers, and number of white-headed woodpecker detections, Payette National Forest, Idaho, during 1991.

region transect name	length (km) of transect in strata type[1] pc	 old	 mat.	percent of transect with dominant overstory[2] pp	 df	 pp/df	 gf	 other	number of detections[3] us	 s
Cuddy Mountains										
Brownlee Guard Sta.			0.69	nd	nd	nd	nd	nd		
Dukes Creek 1		0.81		43	14	43				
Dukes Creek 2		2.58				100				
Lower Johnson Creek			0.74				60	40		
Upper Johnson Creek			1.06	nd	nd	nd	nd	nd		
Little Pine Creek			0.88			100				
Orchid Canyon		0.77				60		40		
Hitt Mountains										
Hitt Creek (ridge)		2.43		nd	nd	nd	nd	nd		
Hitt Creek[4]		1.6		12	25	63				
Mid. Fk. Brownlee 1		0.75				100				
Mid. Fk. Brownlee 2		1.15				80		20	1	

Table 2. (continued) Characteristics of line transects used to survey woodpeckers, and number of white-headed woodpecker detections, Payette National Forest, Idaho, during 1991.

region transect name	length (km) of transect in strata type[1]			percent of transect with dominant overstory[2]					number of detections[3]	
	pc	old	mat.	pp	df	pp/df	gf	other	us	s
Hitt Mountains (continued)										
Lower Mill Creek	0.29		0.57			100			2	1
Upper Mill Creek			1.23		25	75				1
Mulmick Gulch			0.94	40		60			2	1

[1] pc = partial cut; mat. = mature; see Appendix B for explanation of strata types.

[2] Overstory tree species: pp = ponderosa pine; df = Douglas-fir; pp/df = ponderosa pine/Douglas-fir codominate; gf = grand fir; other = grand fir mix.

[3] Detections: us = unsolicited response; s = solicited response

[4] White-headed woodpecker(s) detected on transect while sampling habitat after survey was completed.

harvested stands). Stands of dominant Ponderosa pine large enough to contain an entire transect line were limited to Boulder Creek. All other transects were in mixed-conifer forest (Table 2).

We recorded seven solicited and seven unsolicited responses on nine transects during the survey; none were recorded in the West or Cuddy Mountains (Table 2). Population density could not be estimated due to an insufficient number of detections. Additionally, we recorded pileated (Dryocopus pileatus), downy (Picoides pubescens) and hairy (P. villosus) woodpeckers, Northern flicker (Colaptes auratus), and Williamson's (Sphyrapicus thyroides) and red-naped sapsuckers (S. nuchalis) along transects (data on file at Idaho CDC).

White-headed woodpeckers were seen on two transects after surveys had been completed. We solicited a response from a male on the Cuprum transect, and followed him and a female to an active nest. While sampling habitat along the Hitt Creek transect, we detected two woodpeckers without solicitation.

Habitat Relationships

All unsolicited detections on line transects were recorded in mixed stands of Ponderosa pine and Douglas-fir: two in old forest; three in mature forest; one pair in a partial cut; and one flying over old forest (Table 2). We recorded an unsolicited response on Hitt Creek after the survey was completed in mixed Ponderosa pine/Douglas-fir with mature and older trees.

Stand age and composition were also noted for several unsolicited sightings recorded off transects. We observed a pair foraging in a partial cut stand of mature Ponderosa pine and Douglas-fir at Lafferty Campground on two separate occasions. In a partial cut with 13% canopy cover, we twice observed a male foraging on mature Ponderosa pine (dbh X = 38 cm, SD = 33). On several occasions, we observed woodpeckers foraging in stands of old Ponderosa pine and mature Ponderosa pine/Douglas-fir at Mulmick Gulch. These stands had received minimal selective harvest in the past but were heavily logged during the study.

Mean canopy closure on transects with unsolicited detections, including Hitt Creek, was 54% (SD = 13); average canopy closure on transects lacking detections (X = 64%, SD = 17) was not significantly different (Mann-Whitney $\underline{U}$ = 43, df = 6, 10; $\underline{P} > 0.01$). Average tree density (trees/ha) on transects with unsolicited detections (X = 287, SD = 128) and transects without detections (X = 259, SD = 134) was not different (Mann-Whitney $\underline{U}$ = 29, df = 5, 10; $\underline{P} > 0.01$). Average dbh on transects with unsolicited detections (X = 30 cm, SD = 5) and transects without detections (39 cm, SD = 7) also was not significantly different (Mann-Whitney $\underline{U}$ = 45, df = 5, 10; $\underline{P} > 0.01$).

Mean snag density (snags/0.4 ha) was greater on transects lacking detections than on transects with white-headed woodpecker detections (Figure 2); however, this difference was not significant (Mann-Whitney $\underline{U}$ = 42; df = 6, 19; $\underline{P} > 0.2$). Similarly, no significant difference was found between transects

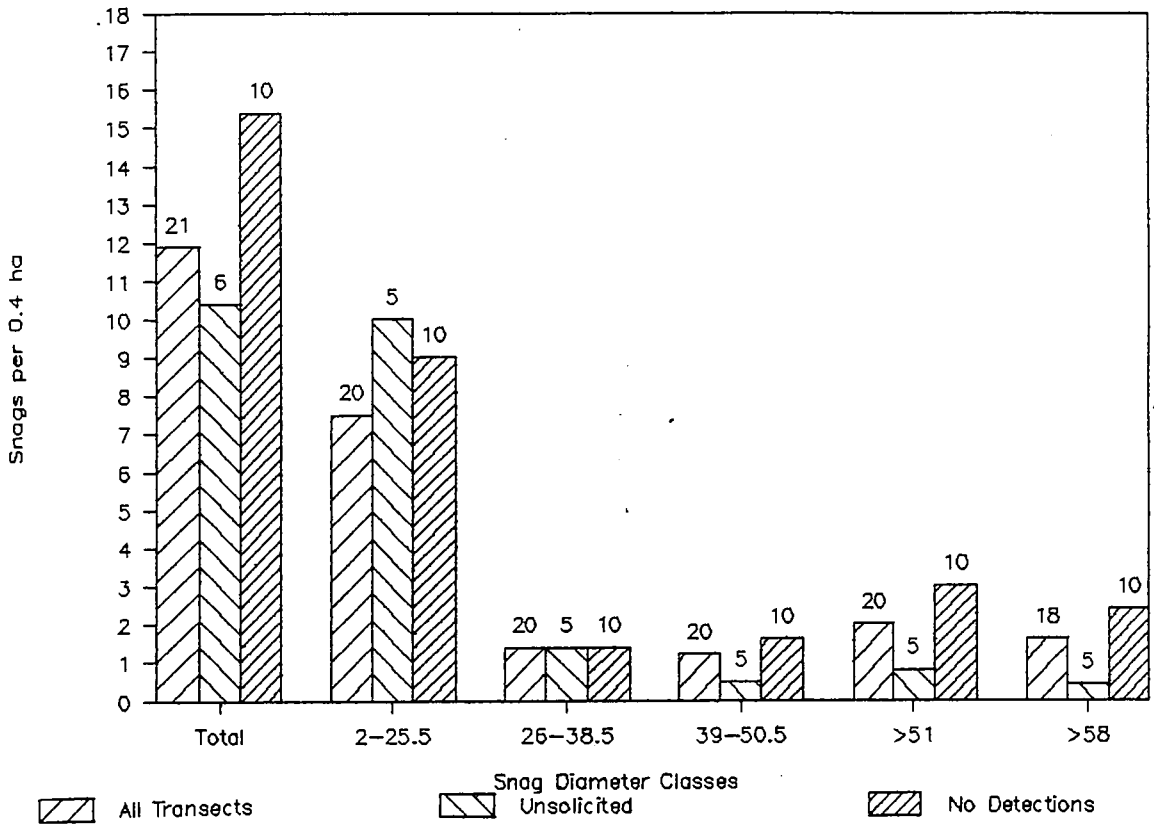

Figure 2. Frequency distribution of snag densities by dbh class recorded in 0.4 ha plots on white-headed woodpecker transects on the Payette National Forest, Idaho, during 1991. Numbers atop bars are number of transects sampled.

with detections and transects without detections for snag dbh 39-50.5 cm (Mann-Whitney U = 41; df = 5, 10; P >0.1); dbh >51 cm (Mann-Whitney U = 43; df = 5, 10; P > 0.01); and dbh >58 cm (Mann-Whitney U = 35; df = 4, 10; P > 0.01).

We found nests in five Ponderosa pines and one Douglas-fir (Table 3). All nests were in completely dead trees. Four nests were in broken-top Ponderosa pines. Mean height of Ponderosa pine snags was 2.5 m. The shortest nest "tree" (1-m-tall) was a sawed-off pine stump, whereas the tallest nest tree was a 19 m Douglas-fir snag. Height of nesting cavity was 0.8 m for the stump, averaged 1.5 m for broken-top snags, and 9 m for the Douglas-fir. Average diameter of nest trees was 56 cm; dbh of the sawed-off stump was 55 cm. Mean nest orientation was northeast (θ = 16°, r = 0.52).

Nest trees had hard outer shells and decayed interiors. Two snags were in advanced stage of decay (stage 7); three were intermediate (stage 6); and one (the Douglas-fir) was relatively firm (stage 4). Bark covered <10% of four snags, 95% of one snag, and 85% of the Douglas-fir snag (Table 3).

Nest trees were found in a variety of habitats (Table 4). Two were located in open, dry meadows. The Middle Fork Brownlee and Bear nests were on the edge of dry meadows. The nest in a sawed-off stump was in a partial cut with light residual cover (i.e., 17% canopy closure). The Cuprum nest site was located in forest relatively far from a meadow edge (>20 m); however, the nest cavity faced a small (<50-m-wide) unforested opening. All

Table 3. Characteristics of white-headed woodpecker nest trees on the Council and Weiser Ranger Districts, Payette National Forest, Idaho, during 1991.

		nest ht (m)		tree ht (m)		dbh (cm)		% bark cover	
species	n	X	range	X	range	X	range	X	range
Ponderosa Pine	5	1.4	0.8-1.9	2.5	2.2- 3.4	53	37-87	26	2-95
Douglas-Fir	1	9.0		19.0		68		85	
All Nests	6	2.8	0.8-9.0	5.2	2.2-19.0	56	37-87	36	2-95

Table 4. Characteristics of white-headed Woodpecker nest sites on the Council and Weiser Ranger Districts, Payette National Forest, Idaho, during 1991. Data are from a 0.04-ha subplot centered on the nest.

nest site	dominant vegetation[1]	strata type[2]	slope (%)	canopy cover (%)	tree density (per ha)	mean dbh (cm)
016 Lower Mill Creek	dry meadow	ncf	41	0		
017 Upper Mill Creek	pp	pc	30	17	66	76 (7)[3]
018 Mulmick Gulch	dry meadow	ncf	39	0		
015 Middle Brownlee Ck	pp/df	old	22	21	55	36 (44)
012 Cuprum	pp	old	21	26	411	20 (15)
011 Bear	pp	mat.	17	3	37	21 (12)

[1] pp = Ponderosa pine; pp/df = Ponderosa pine/Douglas-fir mix

[2] nc = noncommercial forest; pc = partial cut; mat. = mature; see Appendix B for explanation of strata types

[3] standard deviation in parentheses

nests in or along forest edges where in open-canopied, mature or old stands of Ponderosa pine (3 nests) or mixed Ponderosa pine/Douglas-fir (1 nest) (Table 4). Common understory shrubs included Spiraea betulifolia, Symphoricarpos albus, and Amelanchier alnifolia. Minor amounts of cutting were evident at the Cuprum and Middle Fork Brownlee nest sites, whereas the upper Mill Creek nest was within a 11-ha partial cut unit. The latter nest site contained the largest diameter trees of all sites, whereas the Cuprum site had the smallest mean dbh and highest tree density (Table 4).

Ponderosa pine was the principal overstory species in subplots sampled within a 3.1-ha area centered on nests; Douglas-fir was a frequent codominant, however (Table 5). Dry meadow habitats were frequently encountered within subplots. Large diameter, mature Douglas-fir and Ponderosa pine trees occurred singly or in small patches within some meadow habitats. Forested 3.1-ha plots were mature (n = 3 plots) or old (n = 3 plots), open-canopied (X = 27% canopy closure), and sparsely stocked (X = 90 trees/ha). Mean tree dbh pooled across forested subplots was 44 cm; large diameter trees (i.e., dbh >70 cm) were rarely sampled (12 of 72 trees measured). Silvicultural treatments included minor selective cutting (3 plots), partial cut with light residual cover (1 plot), and no treatment (2 plots).

The amount of mature and old forest in 50.3 ha plots centered on nest sites varied widely (Table 6). Forest cover pooled across all plots averaged 21 ha (42%) mature and 15 ha

Table 5. Characteristics of habitats sampled in five 0.04 ha subplots located within a 3.1 ha (99-m radius) area centered on white-headed woodpecker nest sites on the Council and Weiser Ranger Districts, Payette National Forest, during 1991.

	percent of subplots with dominant cover[1]				subplots with >10% canopy closure				
nest site	pp	df	pp/df	n/f	n[2]	strata type[3]	mean percent canopy	mean trees per ha	mean dbh (cm)
Lower Mill Ck			20	80	1	old	35	19	46 (23)[4]
Upper Mill Ck	60	20	20		5	mat.	19 (5)	36 (28)	53 (27)
Mulmick Gulch		20		80	1	mat.	27	62	65 (27)
Middle Brownlee Ck	40	20	40		5	old	27 (15)	72 (34)	40 (24)
Cuprum	60		20	20	4	old	34 (13)	233 (137)	28 (17)
Bear	60			40	3	mat.	20 (13)	116 (83)	30 (18)
Average site	37	10	17	37			27 (7)	90 (78)	44 (14)

[1] dominant cover: pp = ponderosa pine; df = Douglas-fir; n/f = non-forest

[2] number of subplots with canopy closure >10%

[3] strata type: mat. = mature; see Appendix B for explanation of strata types

[4] standard deviation in parentheses

Table 6. Measurements of vegetation strata in 50.3 ha (400 m radius) analysis circles centered on white-headed woodpecker nest sites on the Council and Weiser Ranger Districts, Payette National Forest, Idaho, during 1991.

	strata type (ha)[1]						length (km) of forest edge adjoining vegetation strata			
nest site	mat.	old	pch	pcl	ncf	nf	pch	pcl	ncf	nf
Lower Mill Creek	42				6	2			1.4	0.4
Upper Mill Creek	24	15		11				1.3		
Mulmick Gulch	33	13				4				1.5
Middle Brownlee Creek	8	32	1			9	0.4			1.6
Cuprum	2	27				21				2.4
Bear	17	4	22			7	1.1			1.4
Mean site	21 (15)[2]	15 (12)	4 (9)	2 (4)	1 (2)	7 (7)	0.2 (0.4)	0.2 (0.5)	0.2 (0.6)	1.2 (0.9)

[1] strata types: mat. = mature; pch = partial cut with heavy residual cover (>50% canopy closure); pcl = partial cut with light residual cover (<50% canopy closure); ncf = non-commercial forest; nf = non-forest. See Appendix B for explantion of strata types.

[2] standard deviation in parentheses

(30%) old. As much as 64-83% of forest cover was mature or older. Old forest was abundant at Middle Brownlee Creek and Cuprum but lacking at Lower Mill Creek. No clearcuts occurred within 50.3-ha plots centerd on nests. Non-forested habitats were common, averaging 7 ha (15%) of the analysis area (Table 6).

Non-forested areas formed the major proportion of edge habitat (Table 6). Mean length of edge along forest/non-forest ecotone was 1.2 km. All other edge habitats formed on average <0.5 km of edge within the 50.3 plots.

DISCUSSION

Habitat Relationships

White-headed woodpeckers use a variety of forest types throughout their range but are primarily associated with open-canopied, mature or old stands of Ponderosa pine (Cooper 1969, Ligon 1973, Weber and Cannings 1976). However, monotypic stands of mature/old Ponderosa pine were uncommon in our study area. All unsolicited responses were in mixed stands of Ponderosa pine and Douglas-fir with mature and older trees. We also observed birds foraging and nesting in partial cuts, a habitat not previously reported to be used. All observations were in open-canopied stands (X = 56% canopy closure) with relatively low tree density (X = 289 trees/ha). Thus, during the breeding season white-headed woodpeckers were not restricted to stands of dominant Ponderosa pine or to overmature trees. However, the small number of detections in this study also suggest that

distribution and abundance may have been limited by habitat availability.

White-headed woodpeckers feed mainly on seeds from live cones and on insects foraged from the bark of large diameter (dbh >25 cm) trees (Ligon 1973, Bull et al. 1986, Morrison and With 1987). Mature trees provide seed cones, whereas large diameter trees provide a greater surface area for insect prey. Although we detected white-headed woodpeckers on transects with a mean tree dbh of 32 cm, birds were commonly observed foraging on much larger diameter trees. Live Ponderosa pine was the principal species used in 17 of 21 observations; mean dbh of eight pines was 70 cm (SD = 25). Woodpeckers foraged on green cones of Ponderosa pine (two observations) and Douglas-fir (two observations). In the Sierra Nevada, white-headed woodpeckers also commonly foraged on live trees (81.1% of observations) with a mean dbh of 59 cm (Morrison et al. 1987). However, in an ongoing study in Oregon, nesting woodpeckers foraged primarily on insects in immature and mature stands; during the postbreeding season, woodpeckers foraged mainly in older stands, and rarely used second-growth forest (R. D. Dixon, pers. comm.).

White-headed woodpeckers rarely forage on completely dead snags (Morrison and With 1987, Morrison et al. 1987). The principal value of snags is roosting, drumming, and nesting sites. Roosting cavities protect birds from wind, reduce predation, and provide a microclimate warmer than ambient temperatures (Kendeigh 1961). Suitable roost sites may be

particularly important during winter. Characteristics of trees used for roosting by white-headed woodpeckers need to be studied.

Nests were excavated in a variety of tree diameters in our study as well as in other study areas. We found nests in trees with diameters ranging from 37-87 cm (X = 56 cm). Mean dbh of nest trees in two studies in California was 80 cm (Milne and Hejl 1989) and 64.6 cm (Raphael and White 1984). Nest tree diameter in Oregon and Washington ranged from 19-74 cm (Bull 1980).

Stage of snag decay appears to be a more consistent nest site characteristic than tree diameter. White-headed woodpeckers commonly nest in completely dead, moderately decayed snags (Milne and Hejl 1989). We found four nest trees in broken-topped snags and one nest in a sawed-off stump. The latter was a highly unusual nest site not previously reported in the literature. All but one nest in our study were in an advanced stage of decay. Similarly, most of the 53 nests reported by Milne and Hejl (1989) were in broken-topped snags in a moderate state of decay. Snags with interiors softened by decay were selected apparently because this small-billed woodpecker lacks strong excavating abilities.

Nests were located relatively near the ground. Excluding one nest 9-m up in a Douglas-fir, mean nest height was 1.4 m. Similarly, Milne and Hejl (1989) found that white-headed woodpeckers selected nest heights close (≤10 m) to the ground. Selection of the lower portion of snags for nest cavities may have been related to increasing degree of decay toward the base of snags.

Forest Management Considerations

Snag densities recommended in the Payette National Forest Land and Resource Management Plan (USDA Forest Service 1988) for mixed coniferous, non-riparian forest are 45 snags/40 ha with dbh 2.5 cm, 82 snags/40 ha with dbh 30.5 cm, and 8 snags/40 ha with dbh 51 cm. These snag densities are intended to satisfy snag needs of all cavity-dependent wildlife species at a density equivalent to 60% of maximum potential populations. Although snag densities in our study area exceeded these minimum densities, we cannot extrapolate our snag densities District-wide because we sampled snags primarily in stands with minimal timber harvest.

Payette National Forest snag guidelines make no provision for decay state or snag recruitment. White-headed woodpeckers require snags in moderate to advanced state of decay. Soft snags are relatively rare in managed forests because they develop from hard snags, only a few of which stand long enough to become soft snags (Thomas et al. 1979). Consequently, planning should assure a succession of snag recruits from live trees to snags in early stages of decay (Milne and Hejl 1987).

Current USFS recommendations for the Intermountain Region (Spahr et al. 1991) call for retaining 45 suitable snags (i.e., dbh >58 cm, moderate decay) per 40 ha to support five pairs of white-head woodpecker per 40 ha. Mean density of snags >58 cm dbh on all transects combined was 160 snags/40 ha, well above recommended levels. However, mean density of snags >58 cm on

transects with non-solicited detections fell below the Regional standards. Moreover, not all snags counted were in advanced stages of decay. We found four of six nests in snags with dbh 37-48 cm. In our study area, a shortage of snags with dbh >58 cm may have been partially offset by an abundance of snags with dbh 39-51 cm.

Although snag characteristics commonly are important criteria for nest tree selection, forest characteristics can be an equally important, and frequently more reliable, predictor of nest site selection among cavity nesters (Mannan et al. 1980, Swallow et al. 1986). We found nests in open meadows and forest edges. Forest cover within 3.1 ha and 50.3 ha plots around nests varied in age as well as in species composition. Although all nests had some mature forest within 50.3 ha, the proportion of mature and old forest varied widely. Age of forest stands apparently was unimportant to nest site selection as long as mature or older trees were available. However, white-headed woodpeckers did not nest in stands with canopy cover >26% or tree density >411 trees/ha. Furthermore, silvicultural treatment was minimal (mostly selective cutting). White-headed woodpeckers used a wider range of habitat during the nesting season than has been suggested by previous studies in its northern range (Burleigh 1972, Ligon 1973, Weber and Cannings 1976).

Management Recommendations

1) Current guidelines in the Payette National Forest Management Plan for retaining large snags (dbh ≥51 cm) are

probably inadequate for maintaining white-headed woodpecker populations. We therefore recommend that the Forest follow snag density recommendations established by the Intermountain Region TES program (i.e., 45 snags >51 cm/40 ha; Spahr et al. 1991). All soft snags that are not distinct safety or fire hazards should be retained. Additional potential nest sites may be provided in intensely managed stands by leaving some high-cut (e.g., >3-m-tall) stumps. Nesting success should be monitored in these stands.

2) Surveys should be conducted early in the resource planning process to permit a thorough survey and to avoid conflicts among competing resource uses. Broadcasting audio recordings of woodpecker calls and drumming on variable-width line transects is the most efficient means for confirming presence or absence of white-headed woodpeckers. We recommend a minimum of three survey replications during the breeding season prior to incubation (i.e., early April through late May).

3) Intensive harvesting of mature, large diameter trees, especially Ponderosa pine, threatens the white-headed woodpecker (Spahr et al. 1991). An accurate and complete map of mature and old Ponderosa pine and mixed Ponderosa pine/Douglas-fir is needed to assess the current extent of potential white-headed woodpecker habitat and to evaluate impacts of timber harvest.

4) Effects of forest fragmentation on white-headed woodpecker productivity, gene flow, habitat use patterns, and population stability is currently unknown. We recommend a long-

term (i.e., >3 years) program to monitor productivity, nesting success, and habitat selection in managed and unmanaged stands.

5) Additional surveys of white-headed woodpeckers on Payette National Forest are needed to accurately estimate distribution and relative abundance. In particular, more intensive surveys are needed in the Cuddy and West Mountains.

6) Our study described areas where white-headed woodpeckers occur but did not demonstrate habitat selection. Therefore, we recommend a comparison of used habitats and available, or unused, habitats to elucidate important, and possibly limiting, habitat factors.

7) Postbreeding dispersal and winter habitat requirements need investigation.

8) Insecticides are applied annually to mature Ponderosa pines in campgrounds where we observed white-headed woodpeckers. Research is needed on effects of spraying to woodpeckers in general, and white-headed woodpeckers in particular.

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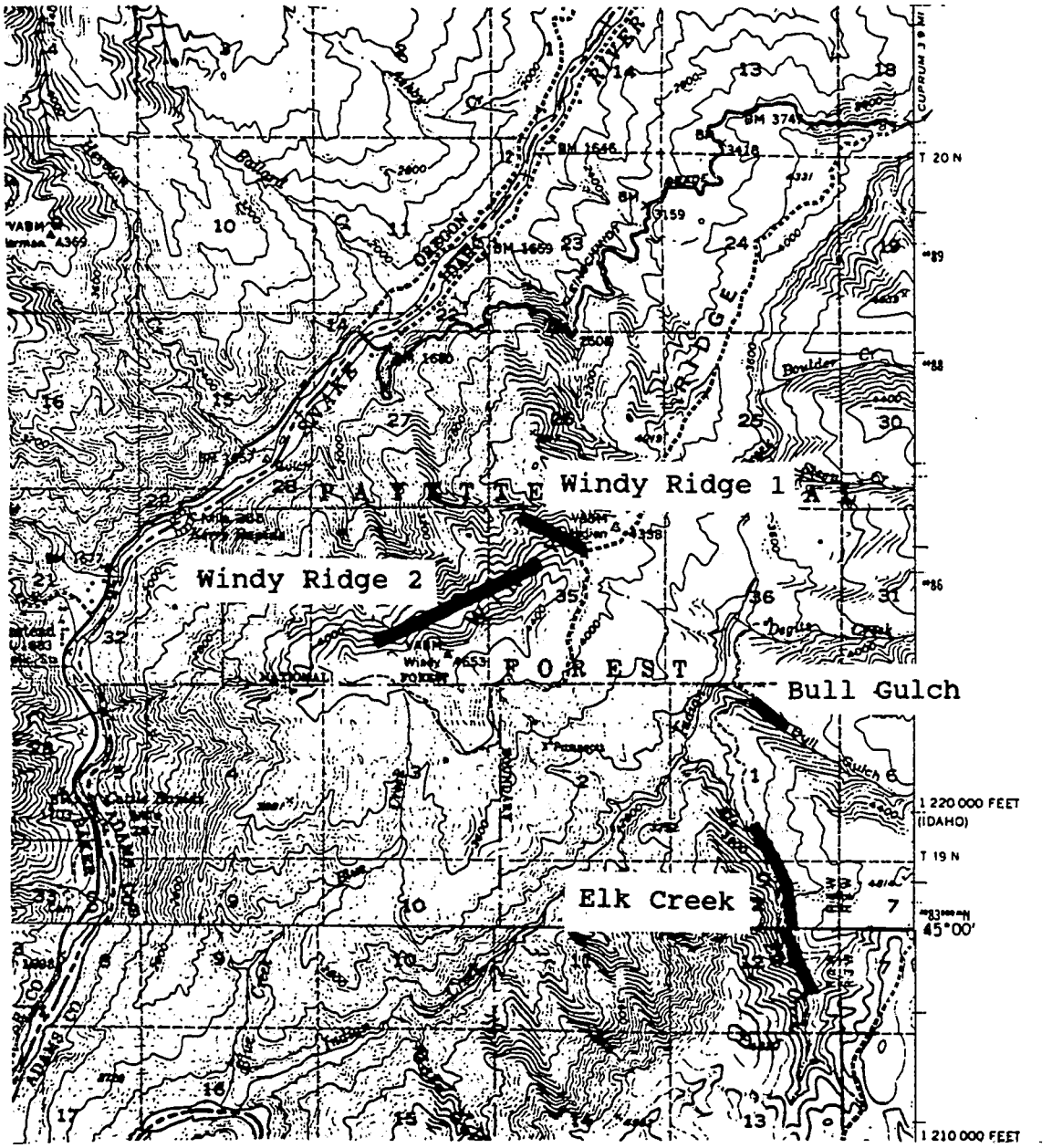
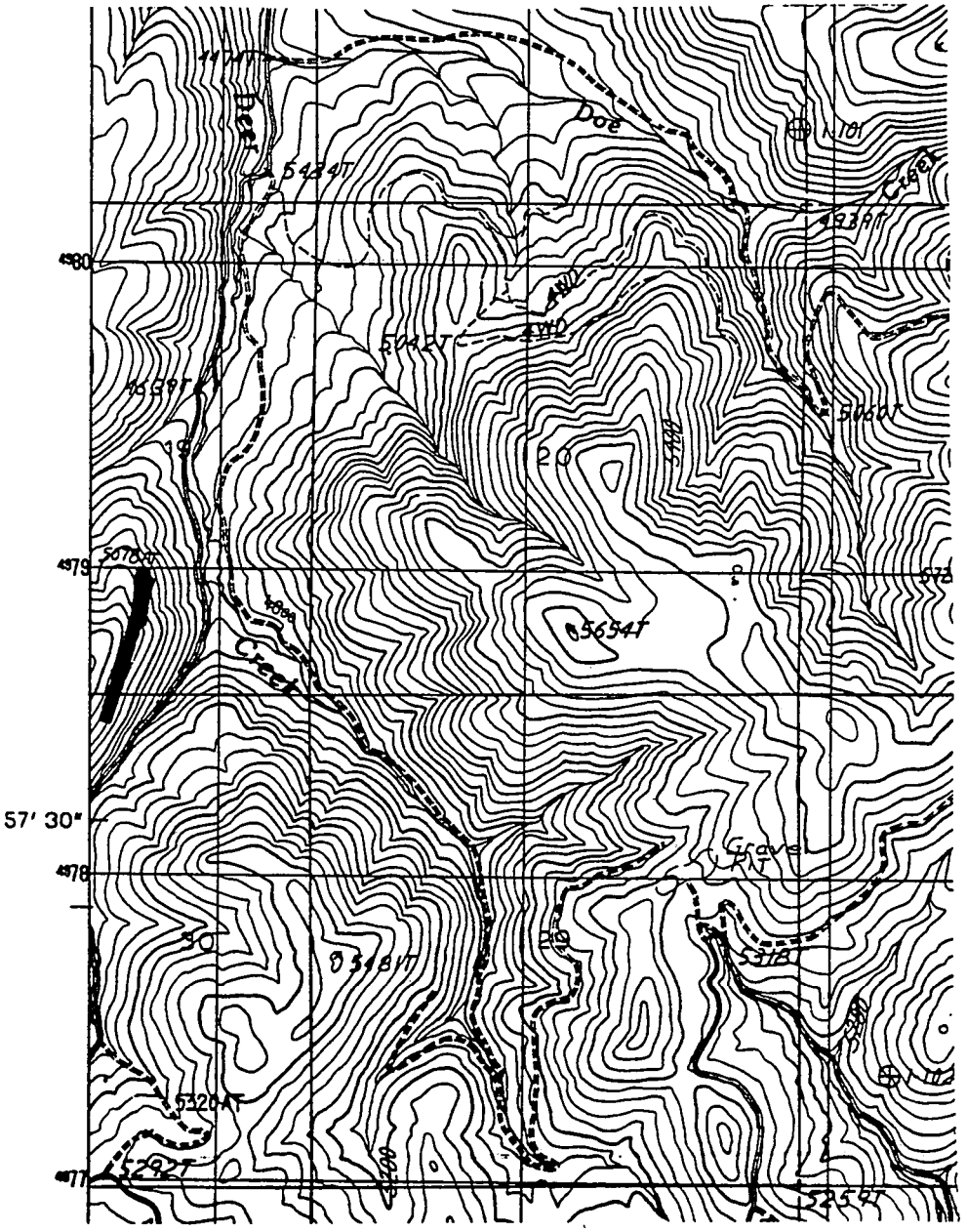
APPENDIX A

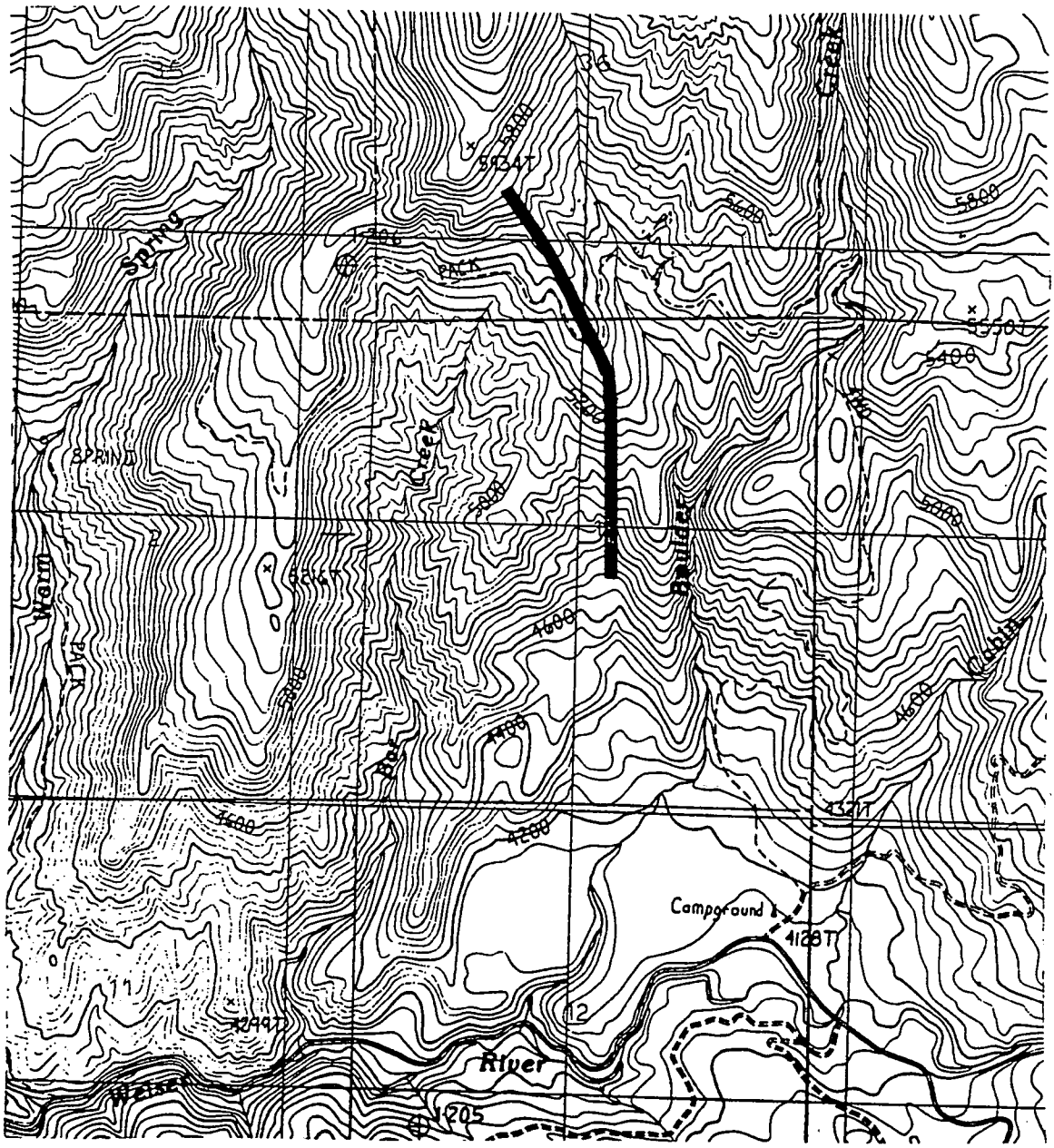
Maps of line-transects used for white-headed woodpecker surveys



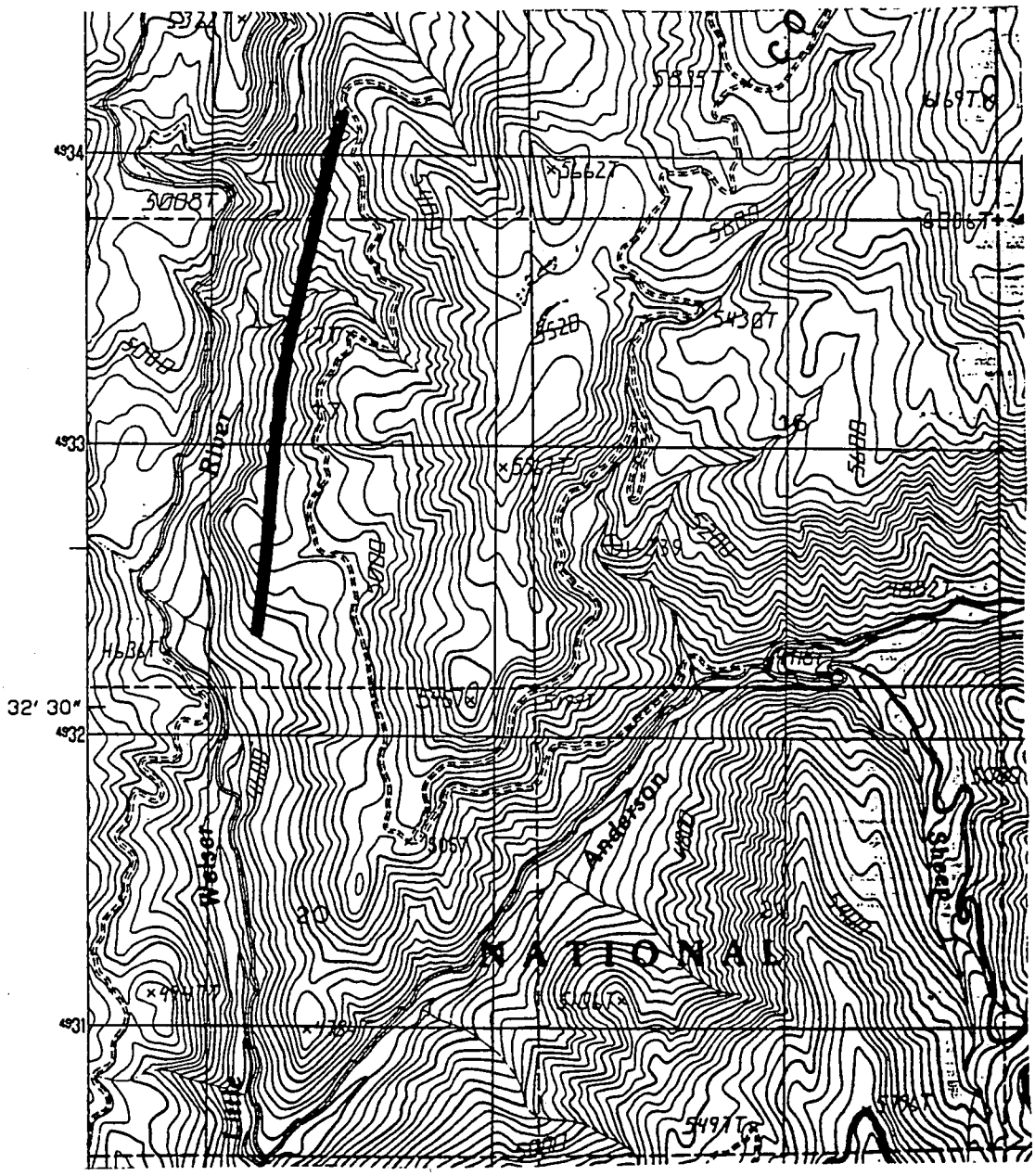
Map 2. Portion of 1957 Homestead and Copperfield 15′ USGS quadrangles showing location of Windy Ridge 1, Windy Ridge 2, Elk Creek, and Bull Gulch transects used to survey white-headed woodpeckers in west-central Idaho during 1991.



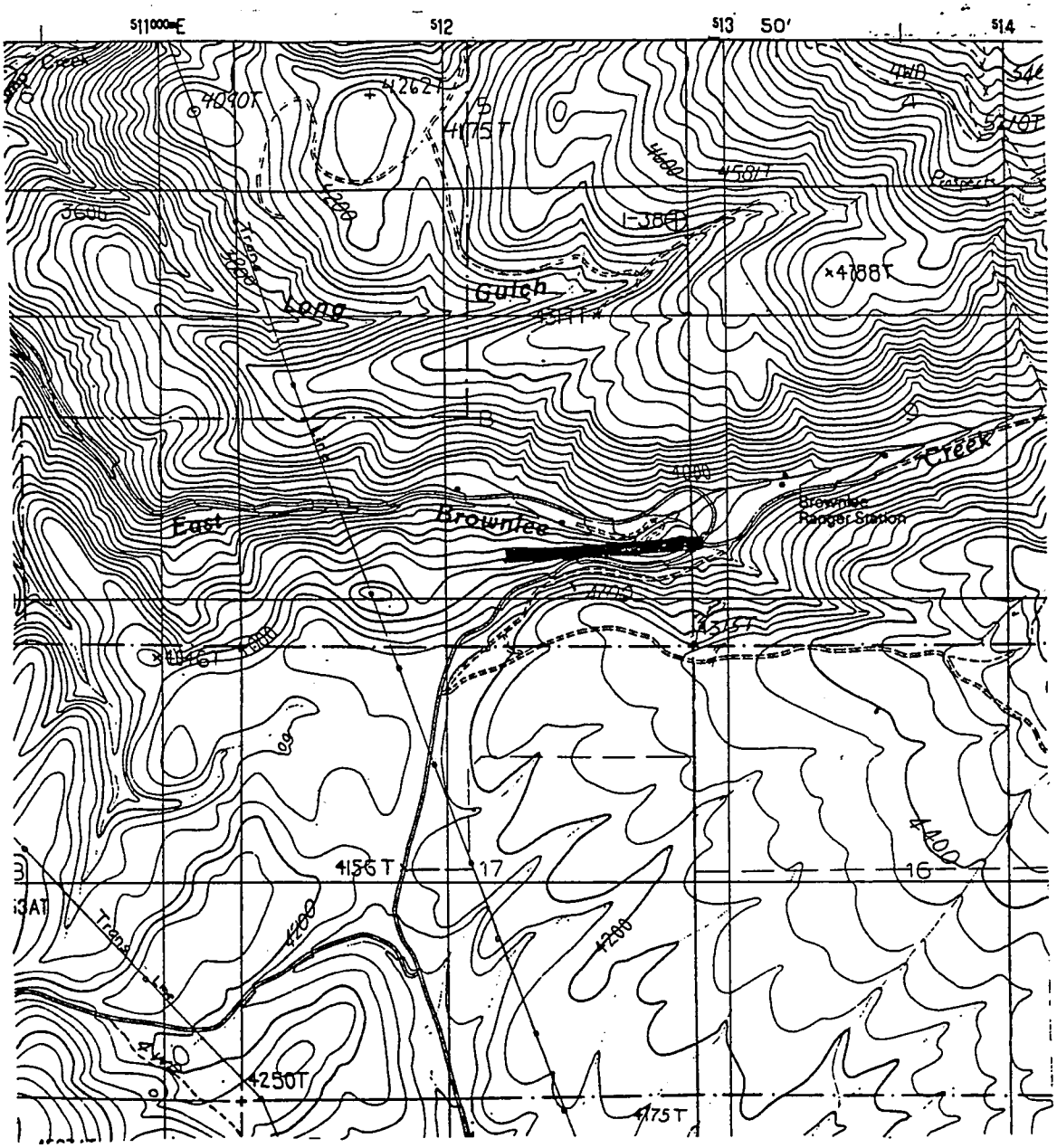
Map 3. Portion of 1986 provisional edition of Weasel Gulch 7.5′ USGS quadrangle showing location of Deer Creek transect used to survey white-headed woodpeckers in west-central Idaho during 1991.



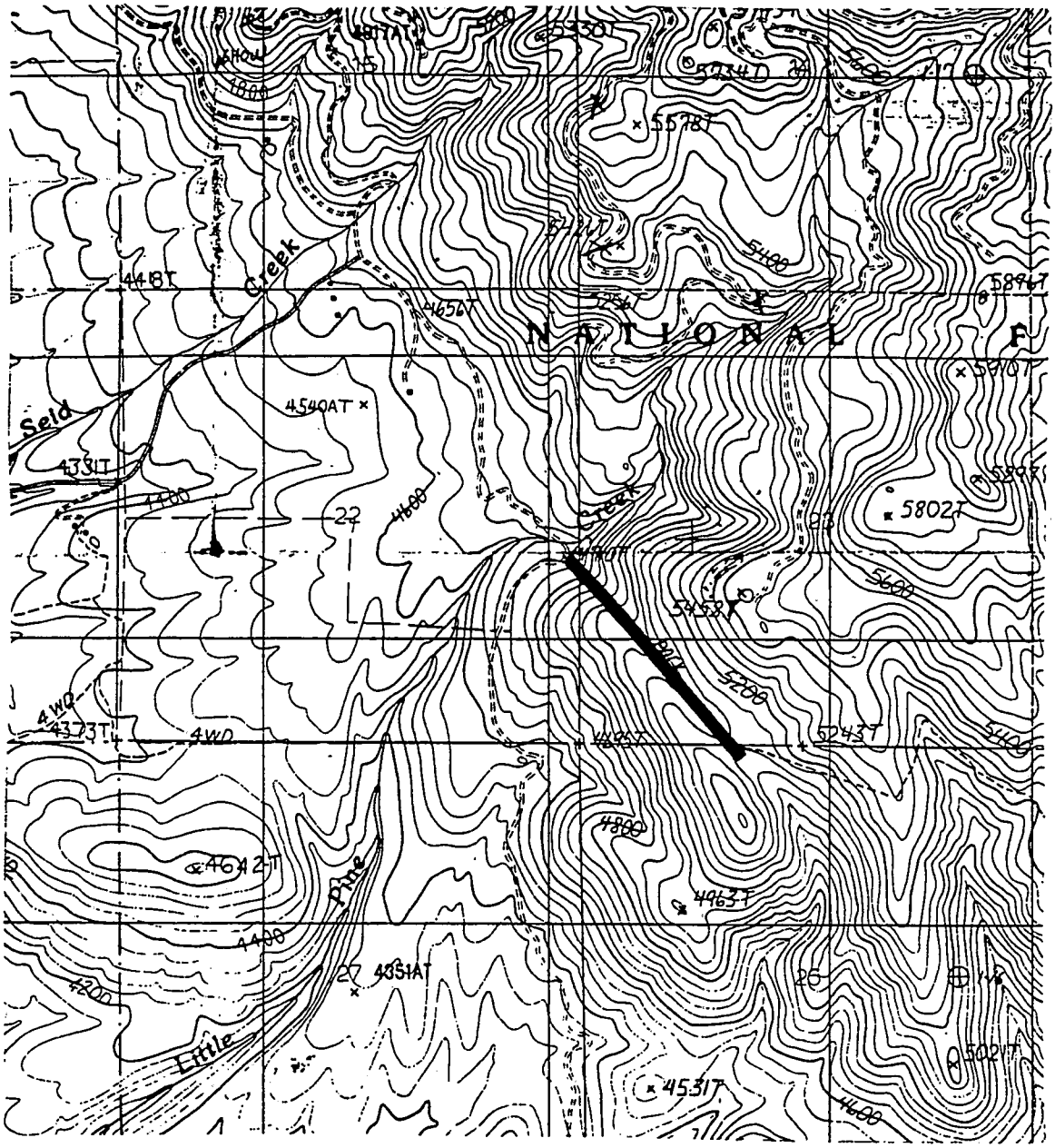
Map 4. Portion of 1986 provisional edition of Council Mountain 7.5′ USGS quadrangle showing location of Boulder Creek transect used to survey white-headed woodpeckers in west-central Idaho during 1991.



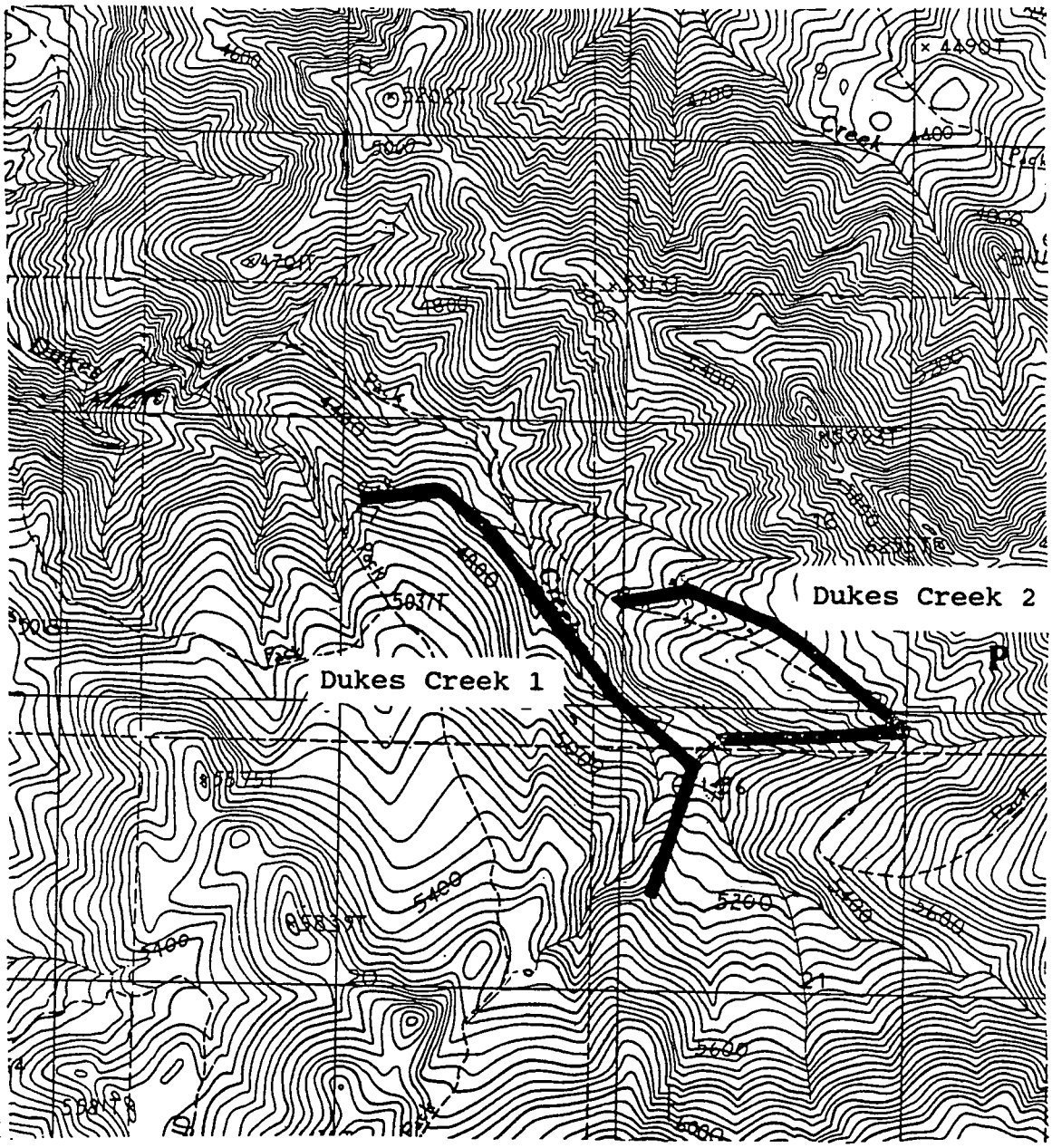
Map 5. Portion of 1985 provisional edition of Cold Spring Ridge 7.5′ USGS quadrangle showing location of Little Weiser River transect used to survey white-headed woodpeckers in west-central Idaho during 1991.



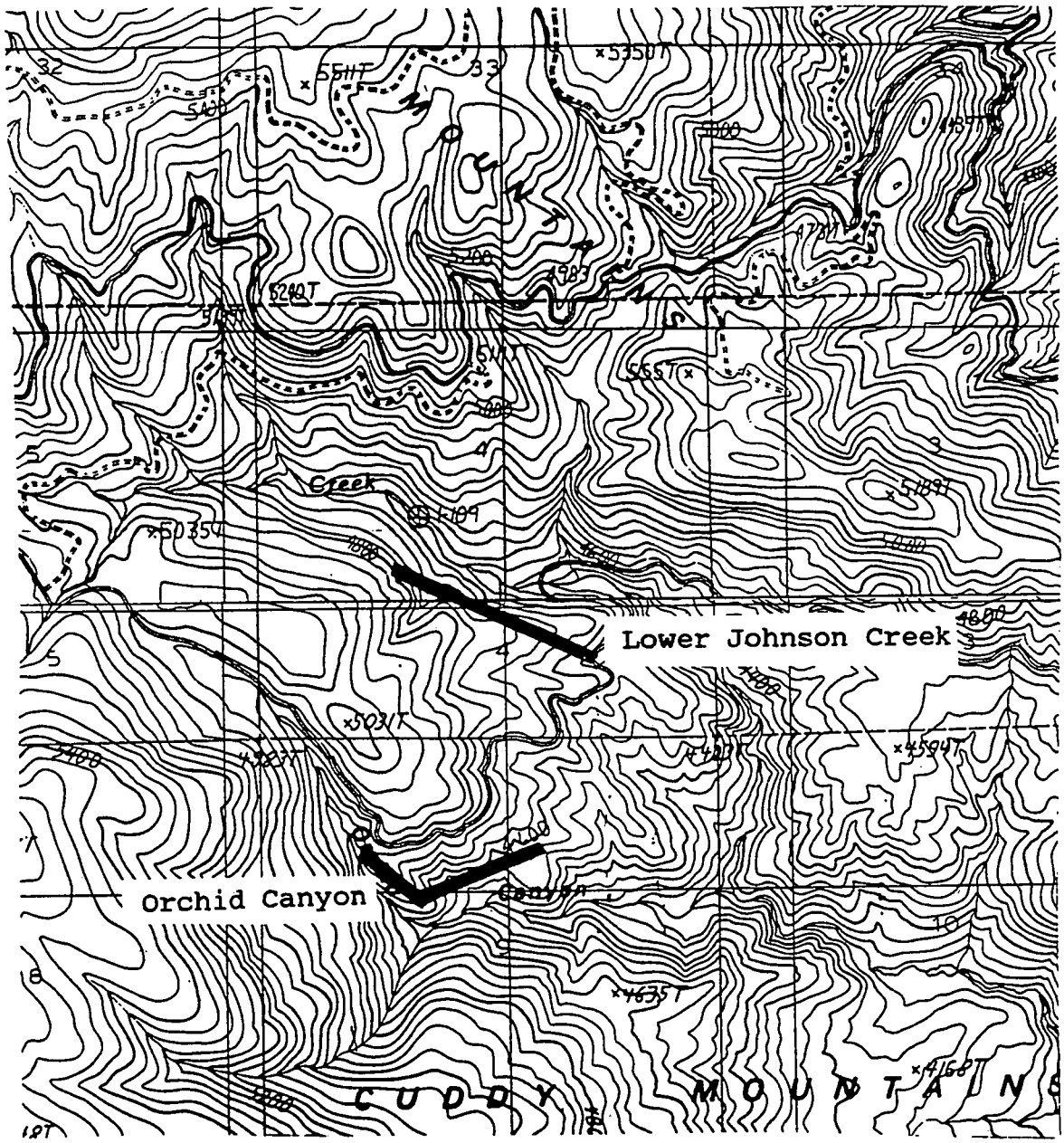
Map 6. Portion of 1987 provisional edition of Advent Gulch 7.5′ USGS quadrangle showing location of Brownlee Guard Station transect used to survey white-headed woodpeckers in west-central Idaho during 1991.



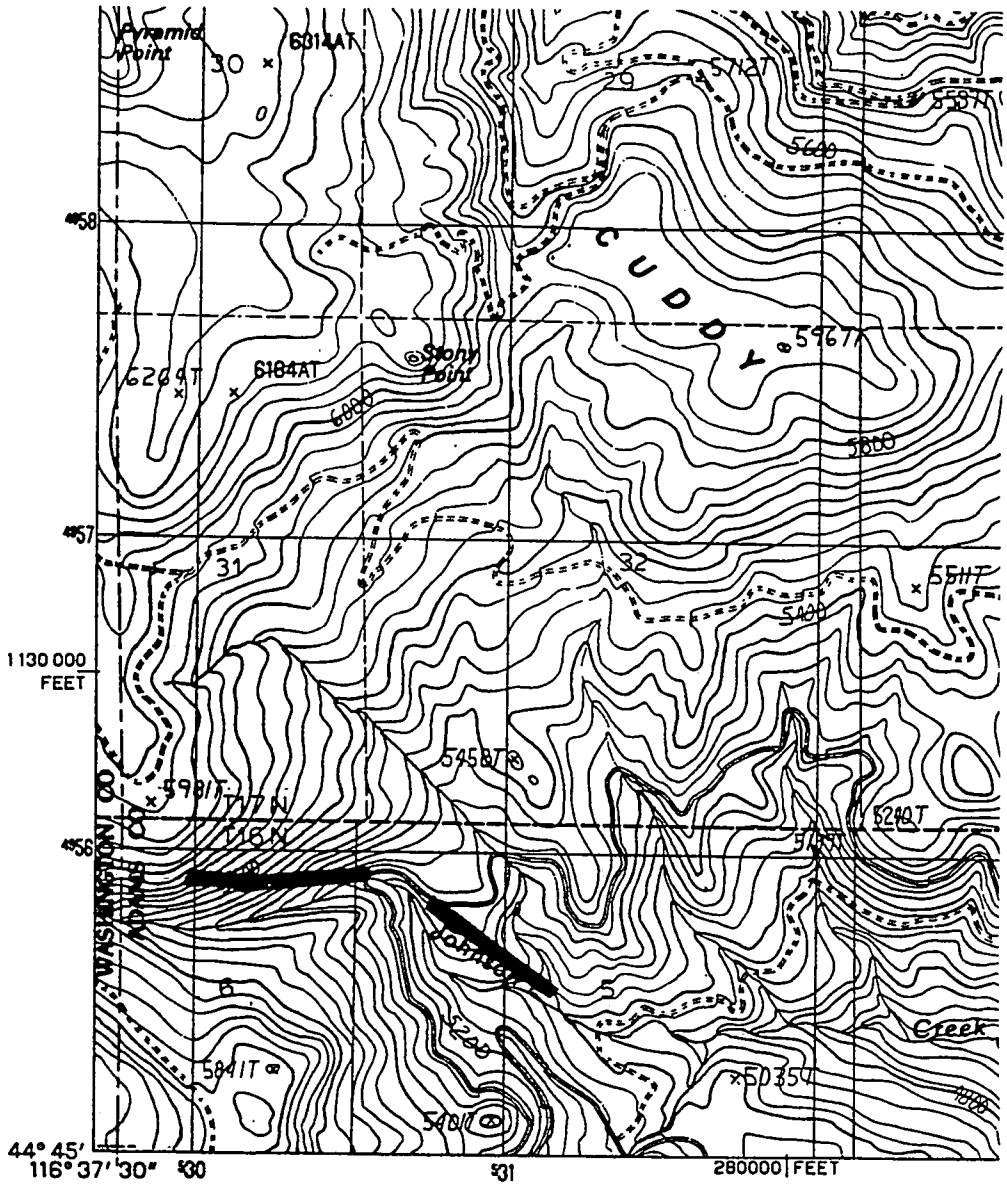
Map 7. Portion of 1987 provisional edition of Advent Gulch 7.5′ USGS quadrangle showing location of Little Pine Creek transect used to survey white-headed woodpeckers in west-central Idaho during 1991.



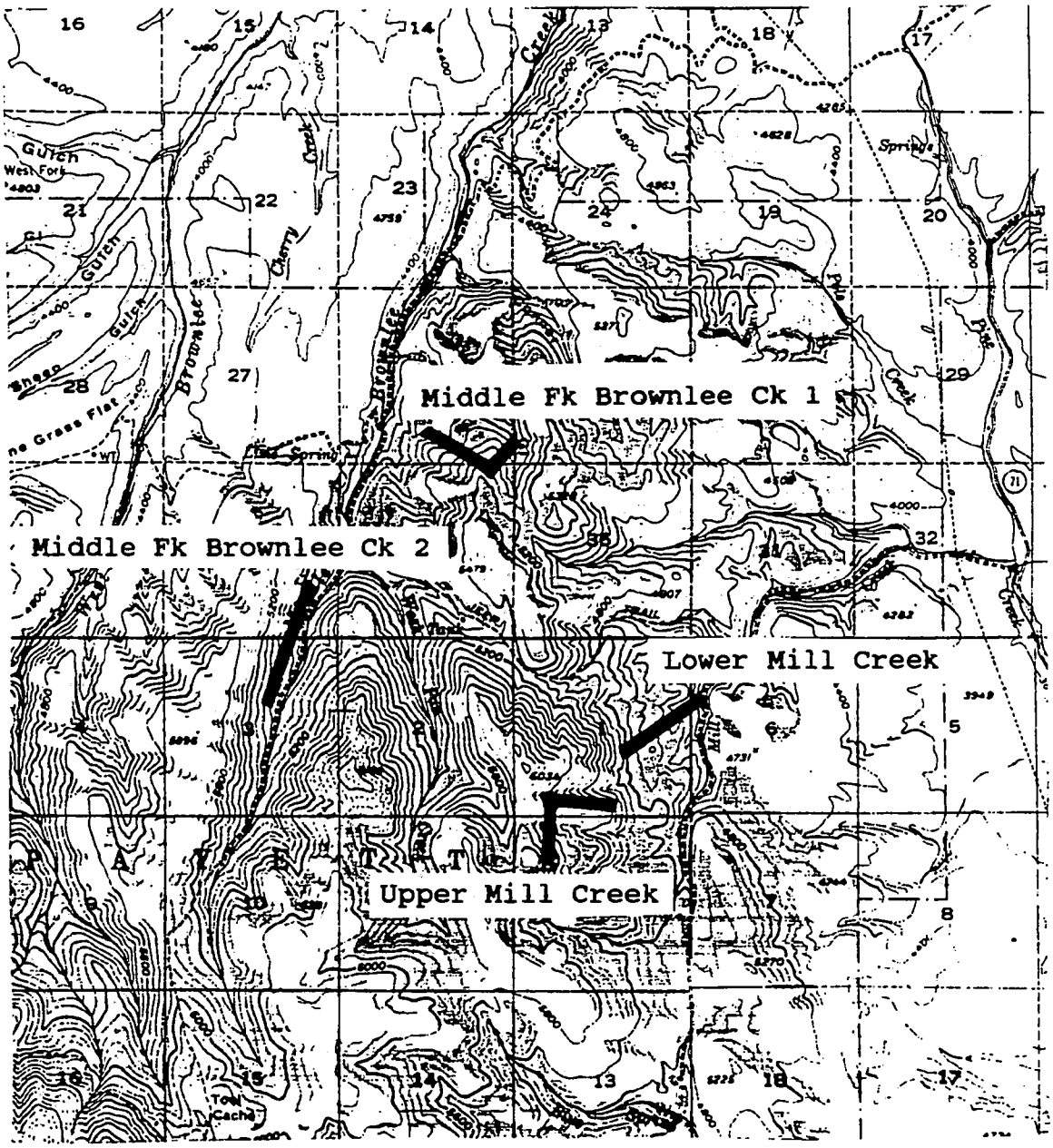
Map 8. Portion of 1987 provisional edition of Cuddy Mountains 7.5′ USGS quadrangle showing location of Dukes Creek 1 and Dukes Creek 2 transects used to survey white-headed woodpeckers in west-central Idaho during 1991.



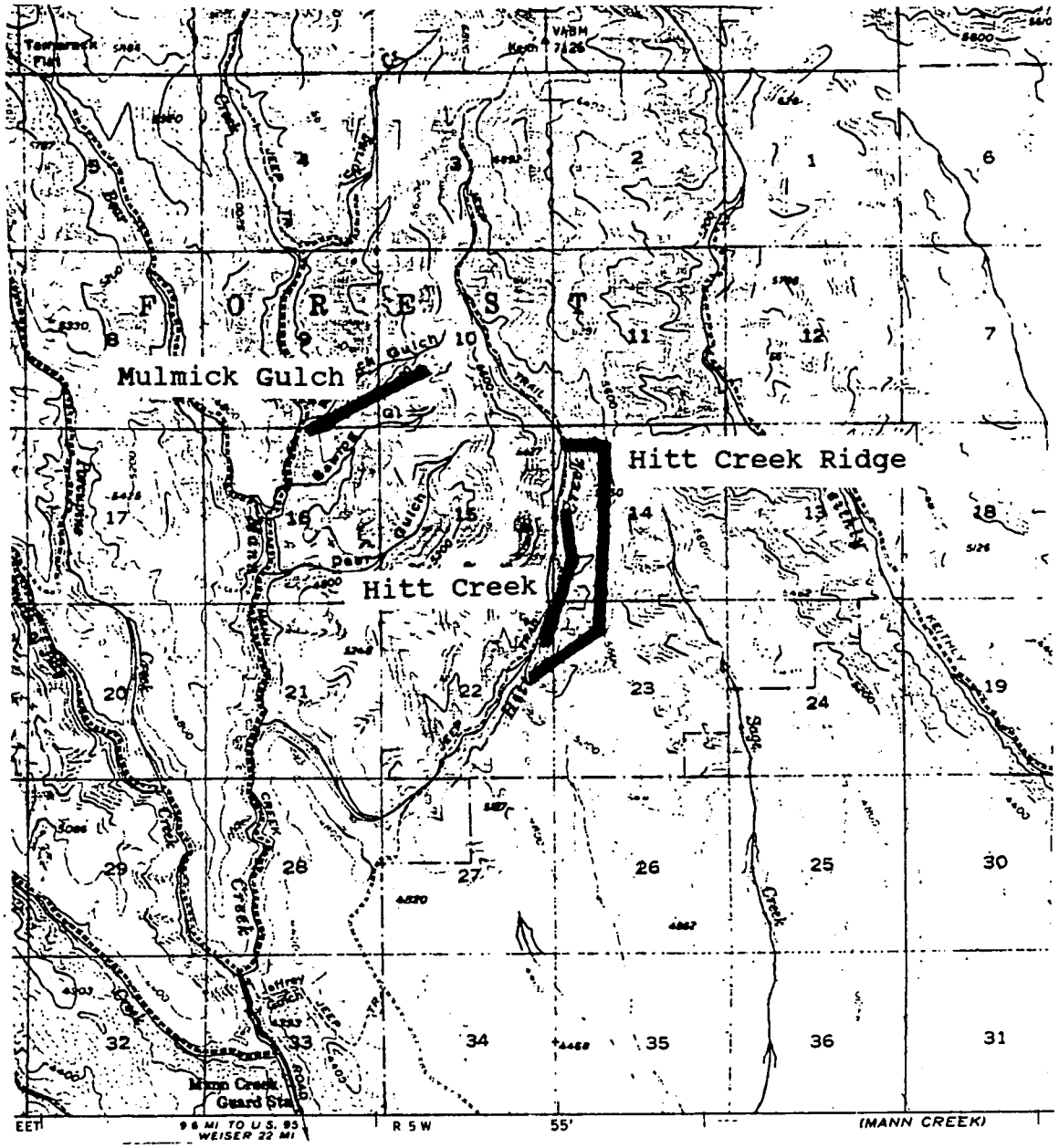
Map 9. Portions of 1986 provisional editions of Goodrich and Peck Mountain 7.5′ USGS quadrangles showing location of Lower Johnson Creek and Orchid Canyon transects used to survey white-headed woodpeckers in west-central Idaho during 1991.



Map 10. Portion of 1986 provisional edition of Peck Mountain 7.5′ USGS quadrangle showing location of Upper Johnson Creek transect used to survey white-headed woodpeckers in west-central Idaho during 1991.



Map 11. Portion of 1957 Sturgill Peak 15′ USGS quadrangle showing locations of Upper and Lower Mill Creek, and Middle Fork Brownlee Creek 1 and 2 transects used to survey white-headed woodpeckers in west-central Idaho during 1991.



Map 12. Portion of 1957 Sturgill Peak 15′ USGS quadrangle showing locations of Hitt Creek Ridge, Hitt Creek, and Mulmick Gulch transects used to survey white-headed woodpeckers in west-central Idaho during 1991.

APPENDIX B

Forest strata codes and definitions

Appendix B. Strata classification codes and definitions used in anlaysis of 50.3 ha plots centered on white-headed woodpecker locations on Payette National Forest, 1991. The 1987 strata were planimetered on orthophotos; the 1990 strata were planimetered on aerial photos.

	Strata Codes		
Strata Name	1987	1990	Definition
Non-forest	60	60,61	Canopy Closure <10%
Clearcut	20	20	Seedlings not visible on photo
Open woodland	40	41	Noncommercial forest: low canopy closure; commercially innaccessable; or regeneration difficult.
Partial Cut (light)	21	21	Canopy Closure <50%
Partial Cut (heavy)	22	22	Canopy Closure >50%
Immature photos;	30,31,32	31,32	Stands with poles, saplings visible on trees generally < 50 years[1]
Mature	26,27,28, 33,34,35	34,35	Stands with trees generally 50 to 100 years.[1]
Old	23,24,25	23,24,25	Stands with trees generally > 120 years.[1]
Other	98,99,private	98,99,private	Water, unclassifiedlands

[1] Ages were based on stand exam verification of aerial photo interpretation.

APPENDIX C

Snag hardness ratings (from Thomas et al. 1979: 64)_

APPENDIX D

White-headed woodpecker sightings reported outside the study area during 1991

Appendix D. Observations of white-headed woodpeckers beyond the Payette National Forest 1991 study area. Information sources include personal observations (Hells Canyon) and Idaho Conservation Data Center.

Region Location	Date	Observation	UTME	UTMN	TRS
Hells Canyon NRA					
Kirkwood Corral	8-21-91	pair, flying	544,200	5,046,000	T26N,R1W,S27,NE
Low Saddle	8-29-91	single, calling	538,700	5,038,900	T25N,R1W,S18,SE
Sawpit Saddle	6-25-91	male	539,500	5,041,400	T25N,R1W,S8,NW
Sawpit Saddle	8-28-91	single, calling	539,400	5,041,500	T25N,R1W,S7,NE
Hells Canyon Wilderness					
Lightening Ridge	7-11-91	single, roosting	539,300	5,033,900	T25N,R1W,S31,SE
Cascade Reservoir					
BSU Osprey Pt. Camp	9-6-91	single, adult	n/a	n/a	T15N,R3E,S17

Submitted by: Craig R. Groves

Approved by:

IDAHO DEPARTMENT OF FISH AND GAME

Tom Reinecker

Tom Reinecker, Chief
Bureau of Wildlife

Wayne Melquist 12/13/91

Wayne Melquist
State Nongame Wildlife Manager &
Endangered Species Coordinator